with a deafening sound. When the wave entered the shallow water the cloud passed overhead, while scarcely more than a gentle breeze was felt. This inrushing of the water was followed by two recoiling waves about one hundred feet apart, which could be seen for a long distance moving back into the lake with about the same velocity as an ordinary storm wave. Following this, the water, which seemed piled up along the shore, soon subsided. Preceding this phenomenon, the lake was unusually calm. At 6.35 a. m., a brisk shower set in lasting fifteen minutes. No peculiar atmospheric conditions preceded the disturbance; the maximum wind velocity in this city for the eight hours preceding 7 a. m. did not exceed ten miles per hour, but the wind blew fiercely south of the city, and at the mouth of the river vessels parted the lines. Hundreds of fish were cast ashore, and the fires in the Lake Erie rolling-mills were put out. A scow loaded with sand at the breakwater was landed high and dry upon the shore. Some iron rails, twenty-eight feet long, piled near the depot, were lifted and scattered in every direction. The wave broke completely over the railroad tracks along the shore, covering them to a depth of several feet and submerging the Erie street pier. On this pier, the flooring of which is eight feet above the level of the lake, a boat-house was wrecked and a man washed overboard and drowned. The damage to property along the shore is roughly estimated at $30,000. The wave is known to have extended from a point five miles east of this city to Fairport, a distance of thirty-five miles. Steamboat men who arrived during the morning report the occurrence of a short squall and sudden movement of the water off this port, of which no especial notice was taken at the time.

The Signal Service observer at Erie reports that between 1.30 and 2.00 p. m., the tidal wave was also slightly felt at that city; the water suddenly rushed over the piers, floating away lumber, etc.

A similar tidal wave occurred on Lake Erie May 10, 1823 at Otter creek, on the Canada shore, and at Kettle creek, twenty miles distant, which attained a height of nine feet. In 1830, three waves were observed at Madison creek, Ohio, the first rising fifteen or twenty feet. In 1844 or 1845 a wave came into Euclid creek, fifteen feet in height. On June 15, 1872, the water rose twenty-six inches at Charlotte, on the mouth of the Genesee river. On November 18, 1845, the water at Cleveland suddenly fell two and eight-tenths feet during a high wind from the southwest, and, according to the "Toledo Blade," a change of ten feet in the waters of Lake Erie took place December 5, 1856. In May, 1855, a similar phenomenon was observed on Lake Seneca, the water continuing to rise and fall from sixteen and a half inches to two feet during two days. Old residents of Conneaut, Ohio, remember a sudden rise of four feet in the lake, covering the orchards upon the flats for several weeks and compelling the people to gather their fruit in boats. Similar agitations of the waters occurred on Lake Geneva, in Switzerland. In 1841, at Berne, the water receded to such an extent as to leave the ships that were at anchor on bare ground.

Like phenomena have occurred on Lake Superior. In 1789, opposite Isle Royal, the water suddenly fell four feet, returning with a great rush. In 1834 the waters above Sault Rapids suddenly receded, and in half an hour returned with great velocity. In August, 1845, an enormous wave, twenty feet in height, was observed between Copper Harbor and Eagle River, rolling towards the shore. In 1847, 1848, and 1849, sudden rises and falls of the waters were repeatedly observed to precede or follow storms on the lake. In 1851, during a perfect calm, the water suddenly rose one foot and three inches, and during another, two and one-half feet. On July 17, 1855, extreme fluctuations on Lake Superior took place between nine in the morning and four in the evening. Other remarkable phenomena of a like nature occurred at the mouth of the Sault Saint Marie, on Lake Huron, in 1856, and at the head of Lake Erie, at Monroe, Michigan, in 1844.

TEMPERATURE OF WATER.

The temperature of water, as observed in rivers and harbors at Signal Service stations, with the average depth at which observations were taken, is given in the table on the right-hand of chart ii. In the first column of the table is given the maximum temperature observed during the month; and in the second column the minimum temperature observed during the same period.

The following table gives the highest and lowest temperature of water at the several stations, with the range of water temperature, mean temperature of the air at the station, and the depth of water at which the observations were taken. It will be seen that the greatest ranges are: 22°.4 at Thatcher's Island, 22° at Toledo, 21° at Grand Haven, 19°.3 at Alpena, and 19° at Chincoteague. The smallest are: 4°.4 at Key West and 5°.4 at Eastport.

Temperature of Water for June, 1882.

STATION.	Temperature at bottom.		Range.	Average depth in feet and inches.	Mean temperature of the air at station.
	Max.	Min.			
	°	°	°	ft. in.	°
Atlantic City	71.5	55.3	16.2	6 7	66.6
Alpena	69.8	50.5	19.3	12 0	57.8
Augusta	88.3	78.	10.8	6 6	78.6
Baltimore	79.5	68.	11.5	9 9	74.0
Boston	66.5	51.	15.5	25 0	65.9
Buffalo	71.	54.3	16.7	10 5	62.4
Burlington					
Cedar Keys	87.	74.	13.0	9 7	79.9
Charleston	84.1	75.4	8.7	41 5	79.3
*Chicago	67.	64.	3.0	7 9	63.6
Chincoteague	83.	64.	19.0	6 0	69.7
Cleveland	72.2	56.1	16.1	14 0	66.2
Detroit	70.	54.	16.0	24 4	67.2
Duluth	62.	45.	17.0	14 4	57.9
Delaware Breakwater	69.4	57.	12.4	8 2	67.9
Eastport	44.2	38.8	5.4	17 3	56.2
Escanaba	67.	49.	18.0	15 0	59.5
Galveston	85.	69.	16.0	14 8	81.3
Grand Haven	72.5	51.5	21.0	19 0	62.9
Indianola	86.3	76.4	9.9	9 4	81.1
Jacksonville	87.	77.	10.0	18 0	91.1
Key West	89.1	84.7	4.4	16 8	84.3
Marquette	52.9	45.9	7.0	10 11	56.5
Milwaukee	61.5	44.6	16.9	8 0	61.4
Mobile	86.3	74.5	11.8	15 11	81.3
New Haven	75.2	58.	17.2	15 2	66.2
New London	63.	56.	8.0	12 8	65.9
Newport	67.5	52.	15.5	11 0	64.2
New York	73.	59.	14.0	22 11	66.1
New Shoreham	63.5	51.	12.5	8 7	66.4
Norfolk	83.	69.	14.0	17 2	75.2
Pensacola	83.8	74.5	9.3	17 10	79.8
Portland, Me	57.6	45.	12.6	19 0	65.1
Portland, Oreg	64.5	53.4	11.1	82 3	62.7
Port Eads					
Provincetown	68.5	53.	15.5	14 0	64.1
Punta Rassa	90.5	80.1	10.4	11 9	80.5
Sandusky	76.4	59.3	17.1	10 0	67.0
Sandy Hook	67.2	55.	12.2	1 5	68.7
San Francisco	61.5	55.9	5.6	28 7	57.0
Savannah	87.4	76.8	10.6	12 2	80.3
Smithville	83.	74.	9.0	10 0	76.9
Thatcher's Island	67.4	45.	22.4	7 0	61.7
Toledo	81.	59.	22.0	11 8	68.1
Wilmington	85.5	75.	10.5	13 0	76.9

*Observations wanting, from 1st to 26th, inclusive.

ATMOSPHERIC ELECTRICITY.

AURORAS.

The most extensive display of the month occurred on the evening of the 14th. It was reported by numerous stations throughout the northern part of the United States. The line of observation extended from Mount Washington, New Hampshire, to Dayton, Washington territory. The most southerly stations at which it was observed, were Springfield, Illinois, and New Corydon, Indiana.

On the summit of Mount Washington, it is reported to have been a faint display, lasting from 8.20 p. m., to the morning of the 15th. Buffalo, from 11.15 p. m., to 1.40 a. m., of the 15th, faint aurora, consisting of a whitish light, seen through the broken clouds. Davenport, Iowa, 11 p. m., until midnight, consisting of a diffuse yellow light, extending to an altitude of 30°. Saint Paul, 10.20 p. m., aurora consisting of a diffuse light of a pale straw color, with dark segment beneath. At 11 p. m., vertical beams beams shot upward to an altitude of

45°; they were of a straw color near the base, and the upper extremities were of a rosy hue. Before disappearing the beams acquired a tremulous motion from west to east. At 11.25 p. m., the display was obscured by clouds. Bismarck, Dakota, 9.30 p. m., faint display; at 10.30 p. m., it extended to the zenith; faint stationary beams and two arches were visible. Helena, Montana, 10 p. m., brilliant aurora covering 30° of the northern horizon. A perfect arch was formed, with numerous parallel rays proceeding from a bank of luminous clouds; these rays had a graceful, undulating motion, and extended nearly to the zenith. The display was most brilliant at midnight and disappeared at 1 a. m., of the 15th.

Numerous displays of less importance have been reported by various stations as follows:

4th: New Corydon, Indiana, 9 p. m.

6th: Vevay, Indiana, 9. p. m.; Burlington, Vermont, 11 to 11.40 p. m.

7th: Saint Vincent, Minnesota, 11 p. m. to 1 a. m., of 8th; Moorhead, Minnesota, 9 to 9.30 p. m.

12th: New Corydon, Indiana, 10 p. m.; Embarrass, Wisconsin; Thornville, Michigan; Gardiner, Maine 10 p. m.; Thatcher's Island, Massachusetts, 11 p. m.

13th: Atlantic City, New Jersey, 10.30 p. m.; New Corydon, Indiana, 11 p. m. to 2 a. m. of 14th.

15th: Oswego, 11 p. m.; Saint Paul, 9.30 p. m.; Atlantic City, New Jersey, 12.10 to 3.05 a. m. of 16th; Manitowoc, Wisconsin; Madison, Wisconsin, 10.30 p. m.; Duluth, Minnesota, 10.30 to 11.45 p. m.; Clinton, Iowa, 11 p. m.; Monticello, Iowa, 10 p. m.; Springfield, Illinois, 10.40 to 11.20 p. m.; Moorhead, Minnesota, 1 to 3 a. m. of 16th; Bismarck, Dakota, 8 to 11 p. m.; Burlington, Vermont, 10 to 11.40 p. m.; Northfield, Minnesota; Independence, Iowa.

16th: New Corydon, Indiana, 10 p. m. to 2 a. m. of 17th; Springfield, Missouri, 11.15 to 11.45 p. m.

17th: New Corydon, Indiana, 11 p. m.

18th: Fort Meade, Dakota.

19th: Saint Paul, 9.30 to 11 p. m.; Alpena, Michigan, 8.50 p. m to 1.30 a. m. of 20th.

20th: Fort Custer, Montana, 10 to 11.10 p. m.; Bismarck, Dakota, 11 p. m. to midnight; Eastport, Maine, 9 to 11.40 p. m.; Gardiner, Maine, 9 p. m.; Thatcher's Island, Massachusetts, 11 p. m. to 2 a. m. of 21st.

21st: Fall River, Massachusetts, 9 p. m.; Cambridge, Massachusetts, 10.15 p. m. to 12.15 a. m. of 22d; Springfield, Massachusetts, visible shortly after midnight; Gardiner, Maine, 12.30 a. m.

22d: Eastport, Maine, 8.15 to 11 p. m.; Mount Washington, 8 p. m. to a. m. of 23d; Burlington, Vermont, 11 to 11.45 p. m.; Marquette, Michigan, 10 to 10.40 p. m.

23d: Mount Washington, 9 to 10.20 p. m.; Burlington, Vermont, 11 to 11.45 p. m.; Alpena, Michigan, 9.25 p. m. to 3 a. m. of the 24th.

24th: Manasquan, New Jersey, 8.30 p. m.; Little Egg Harbor, New Jersey, during early evening; Fort Myer, Virginia, 9.05 to 9.15 p. m.

25th: Marquette, Michigan, 11 to 11.20 p. m.; New London, 1.20 to 4.15 a. m. of the 26th; Agawam, Massachusetts, during early morning.

THUNDER-STORMS.

Thunder-storms were reported in the various districts on the following dates:

New England: 4th, 6th to 9th, 15th to 19th, 23d to 29th.

Middle Atlantic states: 1st, 3d to 6th, 9th to 11th, 14th to 28th.

South Atlantic states: 1st, 4th, 6th, 10th, 11th, 15th to 23d, 25th to 30th.

Florida peninsula: 1st, 4th, 8th to 13th, 20th to 23d, 26th, 27th, 29th, 30th.

East Gulf states: 3d, 8th to 16th, 20th to 30th.

West Gulf states: 2d, 3d, 6th, 7th, 9th to 16th, 18th, 19th, 21st, 25th, 26th, 30th.

Rio Grande valley: 5th, 6th, 9th, 11th, 13th, 19th.

Ohio valley and Tennessee: 1st, 3d, 8th to 30th.

Lower lake region: 3d, 7th to 10th, 14th to 19th, 23d to 26th, 28th, 30th.

Upper lake region: 6th to 10th, 12th to 18th, 22d to 25th, 27th to 30th.

Extreme northwest: 8th, 12th, 13th, 15th, 16th, 17th, 21st, 23d, 24th, 26th to 29th.

Upper Mississippi valley: 1st to 3d, 7th to 30th.

Missouri valley: 1st, 2d, 7th to 30th.

Northern slope: 1st, 2d, 6th to 14th, 16th, 19th to 30th.

Middle slope: 6th to 21st, 24th to 26th, 28th to 30th.

Southern slope: 2d, 5th, 7th to 14th, 16th, 18th to 21st, 25th, 30th.

Northern plateau: 4th to 6th, 8th to 11th, 18th, 23d, 26th, 27th.

Middle plateau: 3d to 5th, 8th to 14th, 19th, 20th, 28th 29th.

Southern plateau: 3d to 10th, 13th to 19th, 27th to 30th.

Middle Pacific coast region: 10th, 12th, 30th.

South Pacific coast region: 15th, 16th, 18th, 19th.

Thunder-storms were also reported from the following stations not included in the districts named above: Portland, Oregon, 4th; Roseburg, Oregon, 3d; Olympia, Washington, territory, 5th, 6th; Fort Bidwell, California, 2d, 25th, 26th; Salinas City, California, 9th, 30th; Carson City, Nevada, 13th, 18th, 28th.

During thunder-storms the following instances of damage by lightning occurred:

Mobile, Alabama, 29th: Lightning struck city tower, damaging the fire-alarm apparatus and the face of the city clock; several persons were stunned.

Chattanooga, Tennessee, 3d: Lightning struck a dwelling in the southern section of the city. The chimney was torn to pieces, window panes were shattered, and an occupant of the house severely shocked.

Grand Haven, Michigan, 18th: Building struck by lightning, damaging the front, side, and part of the roof; several persons were stunned.

Newburg, New York, 16th: A sloop was struck by lightning, and one man killed. At West Newburg, a barn was struck, killing a horse and rendering two men unconscious.

Reading, Pennsylvania, 16th: A stable containing twelve valuable horses was struck by lightning and entirely destroyed, entailing a loss of $4,000.

Davenport, Iowa, 24th: Lightning struck and set on fire Trinity church; several other objects were also struck.

Winnemucca, Nevada, 12th: Lightntng struck and entirely destroyed a milk-house, four miles south of station.

Morrison, Illinois, 16th: Great damage done by lightning; a man killed near Coleta. 24th, several buildings struck by lightning.

Riley, Illinois, 30th: A large oak tree, within ten rods of the observer's house was struck by lightning. The trunk of tree measured about two feet in diameter. Nearly half of the tree was torn off, and some of the fragments, weighing from seventy-five to one hundred pounds, were thrown a distance of one hundred feet; other portions were hurled into the tops of the neighboring trees. Large pieces were split and twisted, resembling bundles of small rope.

Port Jervis, New York, 15th: Lightning struck and considerably damaged the spire of the Catholic church; it also struck and damaged a building at Matamoras.

Cleveland, Ohio, 17th: Barn struck by lightning; one person killed.

Variety Mills, Virginia, 21st: House struck by lightning near Livingston, killing three persons.

The observer on the summit of Pike's Peak reports the occurrence of an unusual electrical phenomenon at that station on the 7th and 9th. At 8.45 p. m. of the former date, the telegraph line was distinctly outlined in bright light. On near approach to the wire, small jets of flame about the size of a

pencil lead, and of a very bright violet, color were observed. It was impossible to touch the flames as they vanished, or escaped to other points on the wire. The cups of the anemometer, which were rapidly revolving, appeared as a ring of fire; the wind vane and other objects were also tipped with light. On approaching the light, the hands and face of the observer were similarly affected, but no heat was felt. The phenomenon was preceded by lightning and thunder and was accompanied by a dense driving snow. It disappeared at 8.55 p. m., simultaneously with the cessation of the snow. A similar display also occurred on the 9th.

West Las Animas, Colorado, 12th: The observer reports that the points of the wind vane were tipped with flame and the anemometer cups revolved in a circle of light.

ATMOSPHERIC ELECTRICITY INTERFERING WITH TELEGRAPHIC COMMUNICATION.

Coleman City, Texas, 13th; Fort McKavett, Texas, 8th, 19th.

OPTICAL PHENOMENA.

SOLAR HALOS.

Solar halos have been observed in the various districts on the following dates:

New England: 5th, 6th, 7th, 10th, 13th, 14th, 17th, 19th, 21st to 24th, 26th, 28th to 30th.

Middle Atlantic states: 7th, 8th, 14th, 19th, 30th.

South Atlantic states: 7th to 10th.

East Gulf states: 4th to 6th, 13th, 21st, 27th, 28th.

Ohio valley: 1st, 2d, 8th, 10th, 11th, 14th to 18th, 20th, 21st, 23d, 30th.

Tennessee: 16th, 18th.

Lower lake region: 6th, 7th, 9th to 12th, 14th, 16th, 17th, 20th, 24th, 26th to 28th.

Upper lake region: 5th, 10th, 20th, 22d, 28th.

Upper Mississippi valley: 1st, 3d, 6th, 8th, 11th, 14th, to 17th, 21st, 27th.

Middle Pacific coast region: 7th, 8th, 13th, 22d, 23d, 26th, 27th, 30th.

Solar halos were also reported from the following stations not included in the districts named above:

Saint Vincent, Minnesota, 13th.
Olivet, Dakota, 27th.
Huron, Dakota, 1st, 2d.
Fort Keogh, Montana, 7th.
Yates Centre, Kansas, 1st, 2d, 3d, 6th, 18th, 19th, 24th.
Palestine, Texas, 13th, 26th.
Indianola, Texas, 1st.
Santa Fé, New Mexico, 4th.
Yuma, Arizona, 7th.
Salt Lake City, Utah, 1st, 4th, 7th.
Mission, Idaho, 7th.
Umatilla, Oregon, 21st.
Albany, Oregon, 16th, 28th.
Roseburg, Oregon, 26th.
San Diego, California, 14th.

LUNAR HALOS.

Lunar halos have been observed in the various districts on the following dates:

New England: 25th.

Middle Atlantic states: 1st, 3d, 14th, 21st, 23d, 25th, 28th, 29th.

South Atlantic states: 23d, 25th, 28th, 29th.

Florida peninsula: 1st, 2d, 27th.

East Gulf states. 1st, 3d, 21st, 22d, 25th, 27th, 28th, 29th.

West Gulf states: 2d, 20th, 22d to 30th.

Ohio valley and Tennessee: 3d, 24th, 26th to 30th.

Lower lake region: 7th, 12th, 23d, 25th, 26th, 27th, 29th.

Lunar halos were also reported from the following stations not included in the districts named above: Moorhead, Minnesota, 30th; Olivet, Dakota, 26th; Alexandria, Dakota, 1st; Dodge City, Kansas, 23d, 24th; Yates Centre, Kansas, 25th; Umatilla, Oregon, 29th; Olympia, Washington territory, 28th.

MIRAGE.

Nantasket Beach, Massachusetts, 24th; Barnegat, New Jersey, 24th, 25th; Indianola, 1st, 2d, 3d, 5th; Alexandria, Dakota, 5th.

MISCELLANEOUS PHENOMENA.

SUNSETS.

The characteristics of the sky as indicative of fair or foul weather for the succeeding twenty-four hours have been observed at all Signal Service stations. Reports from one hundred and eighty-six stations show 5,534 observations to have been made, of which twenty-five were reported doubtful; of the remainder, 5,509, there were 4,420, or 82.2 per cent., followed by the expected weather.

SUN SPOTS.

The following record of observations has been forwarded by Mr. D. P. Todd, Director of the Lawrence Observatory, Amherst, Mass.:

DATE—June, 1882.	No. of new		Disappear'd by solar rotation.		Reappear'd by solar rotation.		Total No. visible.		REMARKS.
	Gr'ps	Spots	Gr'p	Spots	Gr'ps	Spots	Gr'ps	Spots	
1, 3 p. m.	0	0	0	0	0	0	2	2	
2, 4 p. m.	2	5	0	0	1	3	4	7	
3, 5 p. m.	0	2	0	0	0	0	3	8	
5, 2 p. m.	0	2	0	0	0	0	2	6	
6, 2 p. m.	1	1	1	1	0	0	2	6	
3 p. m.	0	0	0	0	0	0	2	6	
7, 7 p. m.	0	0	0	1	0	0	2	5	
8, 2 p. m.	2	6	0	0	1	4	4	11	
9, 4 p. m.	0	8	0	0	0	8	4	19	
10, 3 p. m.	0	10‡	2	3	0	8	2	25‡	
13, 2 p. m.	1	7	.....	.....	1	2	2	33‡	
15, 7 p. m.	0	5	0	0	0	0	2	40‡	
16, 1 p. m.	0	10	0	0	0	0	2	50‡	
18, 6 p. m.	1	5	0	0	1	5	2	55‡	
19, 2 p. m.	0	0	0	0	0	0	3	55‡	
21, 4 p. m.	0	0	1	10‡	0	0	2	45‡	
22, 12 m.	1	5	0	10	1	5	3	40‡	
23, 3 p. m.	0	0	0	5	0	0	3	35‡	
24, 3 p. m.	1	5	1	15‡	1	5	3	25‡	
26, 2 p. m.	2	10	0	0	1	5	5	35‡	
27, 3 p. m.	1	5	0	5	0	0	6	35‡	
29, 3 p. m.	1	5	1	5	1	5	6	35‡	
30, 4 p. m.	1	5	0	0	1	5	7	40‡	

‡Approximated. Faculæ were seen at the time of every observation.

Mr. H. D. Gowey, at North Lewisburg, Ohio, reports sun spots were observed on all clear days during the month. They were least numerous on the 8th, largest on the 14th, and most numerous on the 30th.

Mr. David Trowbridge, at Waterburg, New York, reports: 2d, two groups, two spots; one faint group has disappeared. 6th, one group, one spot. 7th, one group, one stop. 8th, one group, one spot, hazy atmosphere. 9th, one group, two spots; the group observed on 8th has disappeared and a new group appeared by rotation; faculæ in west and east. 11th, two groups, seven spots; the new group observed on the 9th is extensive; a new group has arisen near the middle of the disk; faculæ numerous. 12th, one group, four spots; the new group observed on the 11th has disappeared. 13th, two groups, six spots; the group of the 12th appears to have separated into two. 14th, two groups, thirteen spots; the large group has twelve spots; a new group has appeared by rotation; faculæ in the east. 18th, two groups, seven spots; faculæ in the west. 20th, two groups, ten spots; the large group has disappeared by rotation and a new one has appeared. 21st, two groups, six spots; same as observed on 20th. 22d, two groups, four spots; the spots are fading out. 23d, three groups, five spots; one new group has appeared by rotation. 24th, two groups, three spots; one of the groups observed on the 22d has disappeared; faculæ in the east; 26th, one group, one spot; one of the groups observed on the 24th appears to have faded out. 27th, four groups, eight spots; one group has appeared by rotation; faculæ in the east; 28th, four groups, twelve spots; faculæ. 29th, five groups, eight spots; one new group of nine spots has appeared by rotation.